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Description

Light source comprising a large number of light-emitting diodes

The invention relates to a light source comprising a large number of light-emitting diodes.

In order to provide sufficient light intensities for indicators, displays, back lighting in vehicles, illumination for indication instruments, etc., it has already been proposed for a number of light-emitting diodes to be combined to form what is referred to as an array. In a light source such as this, the light-emitting diodes (LEDs) are located on the mount, which is also provided with a number of contact pads, which make electrical contact with the light-emitting diodes.

A mount populated in such a way is placed, for example, on a solid printed circuit board, which is provided with equivalent contact points. In order to produce the electrical connection, connection elements must be used between the contact pads on the mount and the contact surfaces on the printed circuit, making electrically conductive contact with the contact pads. Each connection thus has two junction points, namely one on the mount and the other on the printed circuit. Furthermore, the light-emitting diodes must be connected to the contact pads on the mount. The wiring is thus very complex.

The invention is thus based on the problem of providing a light source which is of simple construction and can be integrated as easily as possible in a light, under a display, in an optical system or in some other appliance configuration.

The invention therefore proposes that the light-emitting diodes be mounted alongside one another on one face of a flexible printed circuit, and the electrically conductively connected conductor tracks on the flexible printed circuit.

This arrangement has the advantage that the light-emitting diodes can be connected directly to the current-carrying lines on the flexible printed circuit. This therefore reduces the number of connections to be produced.

In order to make the arrangement mechanically robust, it is particularly advantageous to mount the flexible printed circuit on a robust mount, which is at the same time used to dissipate the heat produced by the light-emitting diodes. To this end, this mount is preferably composed of a thermally conductive material, for example copper, and is possibly connected to a heat sink, or is in the form of such a heat sink.

The flexible printed circuit on which the light-emitting diodes are mounted is connected to the mount in a simple manner by means of thermally conductive adhesive.

The electrical connection between the light-emitting diodes and the current-carrying lines on the flexible printed circuit is produced via contact pads, with electrical contacts being made between the LEDs and the flexible printed circuit.

The light-emitting diodes can be integrated individually or as a group of a number of them in the semiconductor chip, in which case sections of the chip can be doped appropriately (also differently). Furthermore, the semiconductor chip may have a corresponding number of contact pads, via which the light-emitting diode section or sections is or are supplied with

power. When using such semiconductors, only the contact pads on the chip need to be electrically conductively connected to the corresponding contact pads on the flexible printed circuit.

This connection can be produced by soldering, bonding or adhesive bonding. The term bonding refers to a specific welding process, which is known per se, and which has been proven for populating printed circuits with electronic components and which is carried out here specifically on the pads on the flexible printed circuit.

In order to make the arrangement robust, the invention also proposes that the light-emitting diodes be arranged in an encapsulation compound, which preferably extends to such an extent that only the light outlet surfaces remain free. This results in a mechanical, extremely robust arrangement. Power is supplied to the light-emitting diodes via the conductor track on the flexible printed circuit, which projects out of the encapsulation compound at the side and can be connected to a rigid printed circuit board via known connector systems.

The invention will be explained in more detail in the following text with reference to an exemplary embodiment. In the figures:

Figure 1 shows a plan view of a light-emitting diode array,

Figure 2 shows a section along the line II-II.

The light-emitting diode array 1 comprises a square mounting board 2, preferably composed of copper. There are boreholes 3 in the corners of the mounting board 2, using which the mounting board 2 can be mounted at a suitable position. A flexible printed circuit 4 is adhesively bonded to one side face, and

has a square accommodation area 5 and a supply line area 6 in the form of a strip. Up to 100 light-emitting diodes 7 are adhesively bonded onto the accommodation area 5, and are represented here only as small square surfaces. These are connected to the conductor tracks 9 via lines 8, of which only a few are illustrated. The connection is made via small contact pads 10, one of which is illustrated schematically. The conductor track 9 and contact pads 10 are part of the flexible printed circuit 4. The illustration of the contact pad 10 and of the line 8, which is a thin wire composed of aluminum or gold, is highly magnified.

The accommodation area 5 has a number of contact pads 10 corresponding to the number of light-emitting diodes. These contact pads 10 are arranged such that electrical contact can be made in a simple manner. In order to supply power to the light-emitting diodes 7, the lines 8 are connected firstly to contact pads - which are not shown in any more detail here because they are so small - on the light-emitting diodes, and to the contact pads 10 on the flexible printed circuit 4.

The bonding process has been particularly proven for connection, in which the lines 8 are welded to the contact pads 10 on the flexible printed circuit 4. This process can be used particularly well when it is necessary to produce a large number of electrically conductive contacts in a very confined space.

The flexible printed circuit 4 which has been populated in this way is adhesively bonded onto the mounting board 2 using a thermally conductive paste. The area of the light-emitting diodes 7 is then surrounded by an encapsulation compound 11, which provides further robustness for the arrangement. As is illustrated schematically in figure 2, the encapsulation compound 11 extends over the edge of the flexible printed

circuit 4 and as far as the upper edge of the light-emitting diodes 7, so that only the light outlet surfaces of the light-emitting diodes 7 remain free. The encapsulation compound 11 makes the arrangement robust, and protects against damage.

As both figures show, the supply line area 6 on the flexible printed circuit 4 projects at the sides. A plug can be attached to its free end, so that it is possible to produce a connection to a socket on a rigid printed circuit board.

The arrangement has the advantage that a large number of light-emitting diodes 7 can be supplied with power via a common line - this being the supply line area 6 on the flexible printed circuit 4. The process of making contact with the light-emitting diodes 7 is considerably simplified, since the lines 8 of the light-emitting diodes 7 just need to be linked to contact pads 10 on the flexible printed circuit 4. The thermally conductive mounting board 2 also results in the entire light source having a good thermal budget.